GaSe is a layered semiconductor from the III-VI family which presents a tunable direct band gap of 2 eV. Optoelectronic properties of this material have already been demonstrated for photodetection applications [1-3]. Nevertheless, actual fabrication methods are based on exfoliated layers and there is a lack of large scale, good quality, elaboration method for 2D materials in general. Working with one-dimensional objects could be an alternative to synthesize very good crystalline quality objects. Here, we demonstrate the VLS growth of GaSe nanoribbons (NRs) by MOCVD on 300 mm SiO2/Si substrates. The crystalline quality of these structures is investigated by HRTEM. Devices are realized on single NR, and optoelectronic properties are studied via photoluminescence and electrical characterizations.

**GaSe PROPERTIES**

- GaSe is generally p-type [7].
- Eg(GaSe) : 2.0 eV (bulk) [8]
- Direct band gap from some monolayers to multilayers.
- Variation of band gap energy depending on the layer number.
- Allow to cover a large spectral range.

**III-VI FAMILY**

- III-VI layered semiconductors family is composed by post transition metals monochalcogenide MXs (with M: Ga or In, X: S, Se or Te).
- Different direct band gap energy for each binary compounds.
- Possibility to combine them and tune the band gap by creating heterostructures.

**CONCLUSION**

- GaSe nanoribbons:
  - Several nanometres wide (average width : 300 nm)
  - Several micrometres long
- Very good crystalline quality observed by HRTEM.
- No defect observed.
- GaSe monolayers stacked along 2-axis.
- Very few nanotubes have been observed. Majority of grown structures are nanoribbons.
- Measured inter-layer spacing of 0.8 nm.
- Energy gap measured by PL on several nanoribbons: E\(_g\) = 1.97 eV

**INTEGRATION AND OPTOELECTRONIC PROPERTIES**

- Sample preparation follows the indicated steps in Fig 6. Contacts are realised by e-beam lithography and Ni-Au are evaporated as electrodes materials.
- Electrical measurements have been led under illumination (white light) and in dark, for temperatures ranging between 25 and 100°C.
- The current level increases with the temperature. Though, the current level is low.
- A photodetection behaviour is observed.
- Current level might be limited either by very low doping level of the NRs or bad contacts/GaSe interface.

**REFERENCES**


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